

THE OLIGOCHAETA OF GEORGES BANK  
(NW ATLANTIC), WITH DESCRIPTIONS OF  
FOUR NEW SPECIES

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*Abstract.*—Thirty-two oligochaete species are recorded from benthic grab samples taken southeast of Massachusetts (Georges Bank). Taxonomic notes are provided for all species not previously dealt with in earlier papers (Erséus and Davis 1984; Erséus 1984a; Davis 1984). Four of the species, *Phallogdrilus dorsospermatheca*, *Phallogdrilus christeri*, *Adelodrilus bacrionis*, and *Uniporodrilus vestigium* are new to science and described herein. Some aspects of sediment-species relationships, life histories, and geographical distributions are discussed.

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During the Georges Bank Benthic Infauna Monitoring Program, 32 species of marine Oligochaeta were encountered (Table 1). Of these 32, 11 are known to be new species. All members of the genus *Adelodrilus*, except *A. bacrionis*, n.sp., from Georges Bank were previously treated by Erséus and Davis (1984). Several species of *Phallogdrilus* have been dealt with by Erséus (1984a), and *Olavius cornuatus* has been described by Davis (1984).

Cook (1969, 1971) studied the Oligochaeta of Cape Cod Bay, Massachusetts. His work was very thorough and is commonly used for reference when studying oligochaetes in shallow waters along the northeast coast of the U.S. Cook (1970a, b) also made significant contributions to the knowledge of deep-sea oligochaetes from the northwest Atlantic. Several other publications (Brinkhurst 1965, 1966; Brinkhurst and Jamieson 1971; Brinkhurst and Baker 1979; Lasserre 1971; Cook and Brinkhurst 1973) are useful for identification of marine oligochaetes from the northwest Atlantic, but are concerned again mostly with shallow-water forms.

Only in the last few years have publications (Erséus 1979a, b, 1983a; Baker and Erséus 1979) dealt with the oligochaetes from the continental shelf of the northeast U.S. The material from the Georges Bank Monitoring Program provides a significant contribution to the knowledge of marine oligochaetes from this area.

#### Materials and Methods

All samples were taken in the course of the Georges Bank Benthic Infauna Monitoring Program performed by Battelle New England Marine Research Laboratory for the U.S. Department of the Interior, Minerals Management Service (Final Report for year one available through the National Technical Information Service). Starting in July 1981, samples were taken in February, May, July, and November of each year through May of 1984. Samples were taken with a 0.04 m<sup>2</sup> Van Veen grab. The samples were subsequently sieved through a 300  $\mu$ m screen and fixed in 10% formalin. In the laboratory, the samples were resieved through a stack of 500  $\mu$ m and 300  $\mu$ m screens and transferred into 70% isopropanol for processing and storage. Oligochaete specimens were stained in Harris haematoxylin or paracarmine and mounted in permanent mounting media on

Table 1.—List of species from Georges Bank.

Tubificidae		
<i>Adelodrilus anisotosus</i> Cook, 1969*	<i>Uniporodrilus vestigium</i> , n. sp.	
<i>A. bacrionis</i> , n. sp.	<i>Bathydrilus longus</i> Erséus, 1979	
<i>A. correptus</i> Erséus and Davis, 1984*	<i>Heterodrilus occidentalis</i> Erséus, 1981	
<i>A. cristatus</i> Erséus, 1983*	<i>Limnodriloides barnardi</i> Cook, 1974	
<i>A. inopinatus</i> Erséus and Davis, 1984*	<i>L. medioporus</i> Cook, 1969	
<i>A. multispinosus</i> Erséus, 1979*	<i>Tubificoides intermedius</i> (Cook, 1969)	
<i>A. pilatus</i> Erséus and Davis, 1984*	<i>Tubificoides</i> , sp. A	
<i>Phallogrilus biprostatus</i> (Baker and Erséus, 1979)*	<i>Tubificoides</i> , sp. B	
<i>P. boeschi</i> Erséus, 1984*		
<i>P. coeloprostatus</i> Cook, 1969*	Enchytraeidae	
<i>P. davisii</i> Erséus, 1984*	<i>Marionina welchi</i> Lasserre, 1971	
<i>P. dorsospermatheca</i> , n. sp.	<i>Grania</i> , sp. A	
<i>P. christeri</i> , n. sp.	<i>Grania</i> , sp. B	
<i>P. flabellifera</i> Erséus, 1984*	<i>Grania</i> , sp. C	
<i>P. parviatriatus</i> Cook, 1971	<i>Grania</i> , sp. D	
<i>Phallogrilus</i> , sp. A		
<i>Olavius cornuatus</i> Davis, 1984*	Family unknown	
<i>O. tenuissimus</i> (Erséus, 1979)	<i>Oligochaeta</i> , n. fam., sp. A	

\* Denotes species which have been dealt with in previous publications.

glass slides. The type-series of the new species are deposited at the United States National Museum of Natural History (USNM), Washington, D.C.

### Area Studied

Figure 1 is a map of the area southeast of Massachusetts showing Georges Bank and the surrounding area where the samples were taken. Station 5 was the location of a drilling platform and was designated as the "site-specific station." Station 5 consisted of an array of 29 stations (5-1 to 5-29) located around the drill site. The remainder of the stations were located at key sites on Georges Bank and were designated as "regional stations."

### Systematics

#### *Adelodrilus bacrionis*, new species

Figs. 2, 3

*Holotype*.—USNM 97236.

*Type-locality*.—Georges Bank, SE of Massachusetts, USA, sta. 5-28, 40°39.5'N, 67°41.9'W, 75 m, medium to coarse sand, Nov 1983.

*Paratypes*.—USNM 97237–97238. Two specimens from off Massachusetts (Georges Bank), sta. 2, 40°59.0'N, 66°55.8'W, 71 m, medium to coarse sand, Nov 1983.

*Other material examined*.—Five specimens from off Massachusetts (Georges Bank): 4 from type-locality, one from sta. 5-3, 40°39.8'N, 67°46.1'W, 78 m, medium to coarse sand, Nov 1981.

*Etymology*.—The name *bacrionis* is Latin for "ladle," referring to the shape of the giant penial setae of this species.

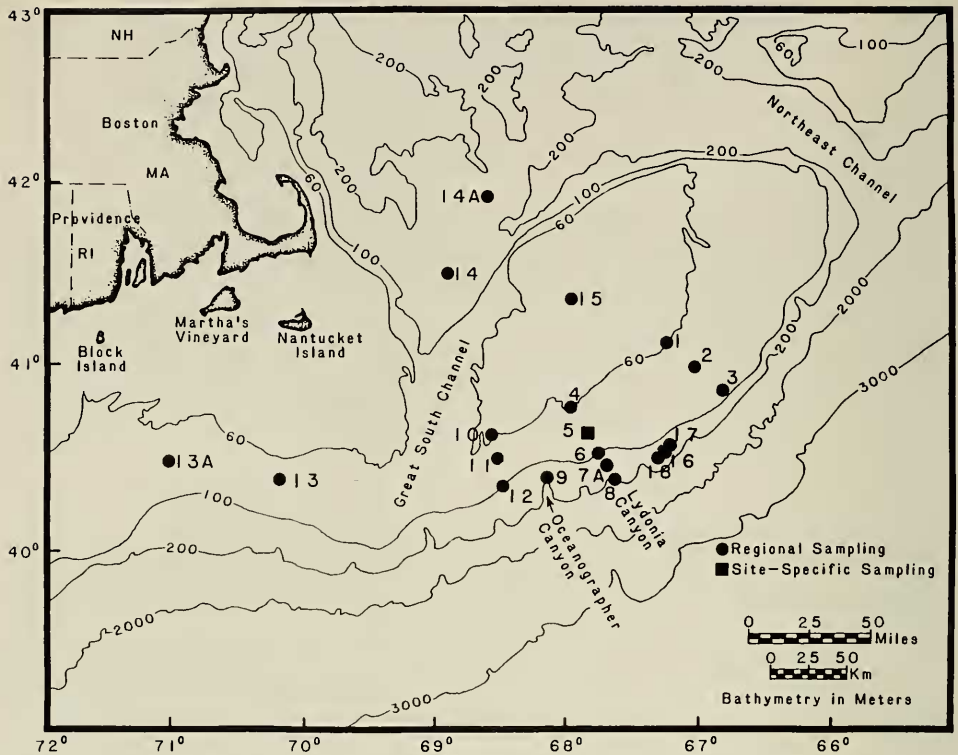


Fig. 1. Map showing positions of sampling stations.

*Description.*—Length 1.9–3.0 mm, 26–33 segments; diameter: 90–151  $\mu\text{m}$  anteriorly, 116–148  $\mu\text{m}$  at segment XI, 62–142  $\mu\text{m}$  posteriorly. Clitellum not observed in these specimens. Secondary annulation weak, 3–4 annuli per segment. Prostomium conical and rounded. Somatic setae (Fig. 3C) similar throughout except ventral setae of segments IX and X in mature specimens. Somatic setae slightly sigmoid; bifid with small, short teeth; upper tooth smaller than lower tooth; 41–59  $\mu\text{m}$  long, 1.5–1.8  $\mu\text{m}$  thick, 2–4 per bundle anteriorly; 32–48  $\mu\text{m}$  long, 1.4–1.8  $\mu\text{m}$  thick, 2–3 per bundle except in specimens in transition stage where normal somatic setae may still be present to give 3–5 per bundle; one or two setae of a modified bundle bifid, slightly enlarged, 41–63  $\mu\text{m}$  long, 1.8–2.5  $\mu\text{m}$  thick; one seta of modified bundle sharply single pointed, larger than bifid setae of same bundle, 48–68  $\mu\text{m}$  long, 2.7–3.2  $\mu\text{m}$  thick. Ventral setae of XI highly modified into penial bundles, each containing: (1) one giant seta (Figs. 2:gs, 3A) with long, slightly sigmoid shaft much widened and cupped ectally to form ladle shape; 120–146  $\mu\text{m}$  long, 10.0–10.8  $\mu\text{m}$  thick at middle (much wider ectally); (2) one medium-sized, simple-pointed seta (Figs. 2:is, 3B) with 90 degree bend in middle and near ental end, slightly curved ectally, 86–98  $\mu\text{m}$  long, 3.6–4.5  $\mu\text{m}$  thick at middle; (3) 4–7 thin ectally hooked, small setae (Fig. 2:ss) 29–33  $\mu\text{m}$  long, 0.9–1.1  $\mu\text{m}$  thick. Giant and intermediate penial setae parallel and small penial setae perpendicular to long axis of worm. Ectal ends of penial setae located within deep, folded copulatory sacs.

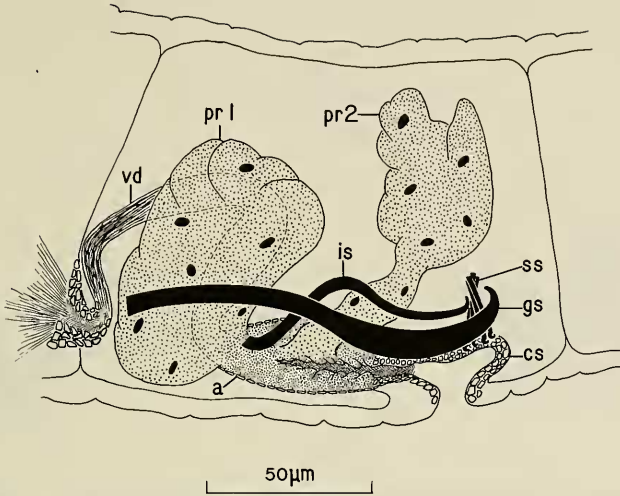


Fig. 2. *Adelodrilus bacrionis*, lateral view of male genitalia in segment XI. a, atrium; cs, copulatory sac; gs, giant penial seta; is, intermediate penial seta; pr1, anterior prostate gland; pr2, posterior prostate gland; ss, small penial setae; vd, vas deferens.

Pharyngeal glands small and lobed, located in V and anterior part of VI. Male genitalia (Fig. 2) paired in XI. Vas deferens thin-walled and broadly dilated; 5–18  $\mu\text{m}$  wide, about 150  $\mu\text{m}$  long; filled with random sperm; entering apex of atrium. Atrium elongate-oval; 54–75  $\mu\text{m}$  long, 23–34  $\mu\text{m}$  wide; thin outer lining; thick, granulated and ciliated inner epithelium; opening into inner end of copu-

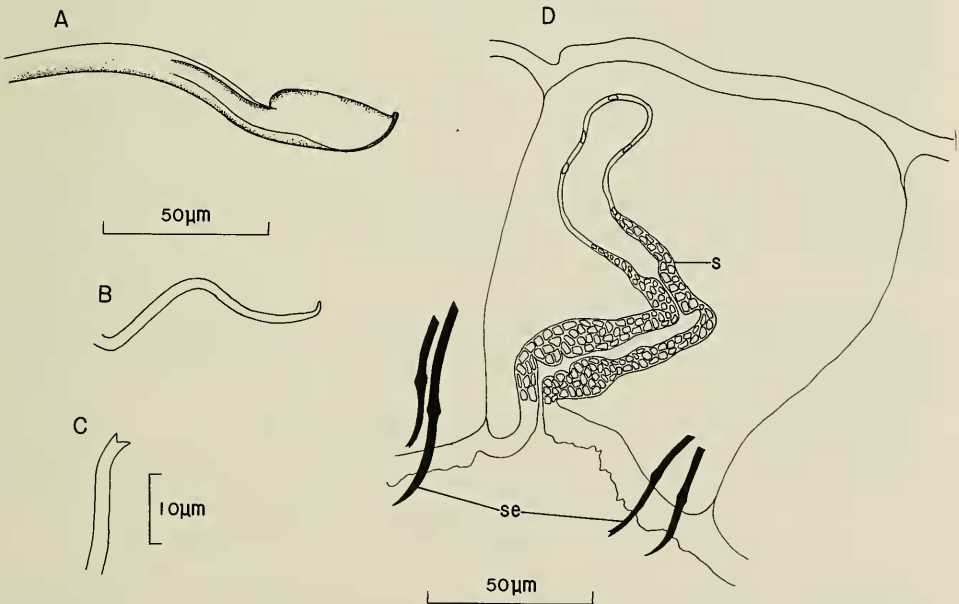


Fig. 3. *Adelodrilus bacrionis*: A, Giant penial seta; B, Intermediate penial seta; C, Somatic seta; D, Lateral view of segment X. s, spermatheca; se, ventral setae of segments IX and X.



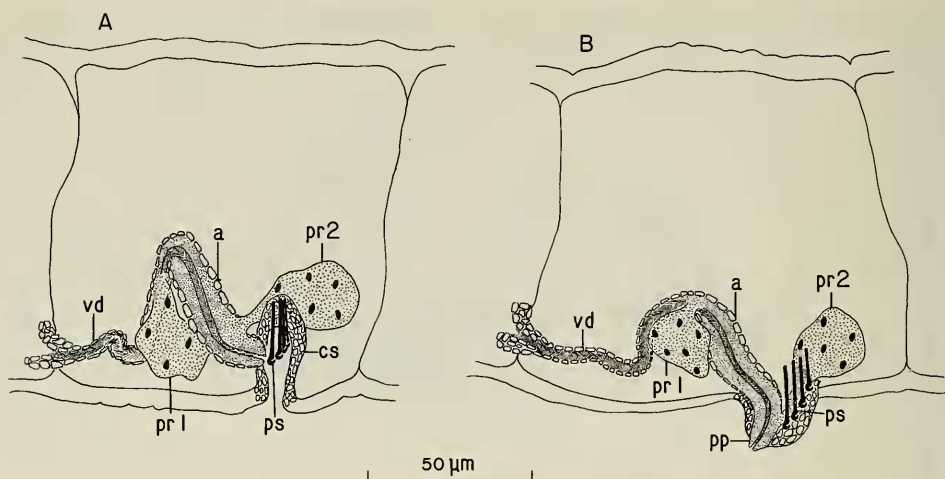


Fig. 4. *Phallodrilus dorsospermatheca*: A, Lateral view of male genitalia in segment XI, with pseudopenis retracted; B, Lateral view of male genitalia in segment XI, with pseudopenis everted. pp, pseudopenis; ps, penial setae; other abbreviations as for Fig. 2.

latory sac. Anterior prostate gland large, somewhat lobed; positioned anterior and dorsal to atrium; attached to ental end of atrium, near entrance of vas deferens. Posterior prostate smaller than anterior prostate; also somewhat lobed; positioned dorsal and posterior to atrium, attached by long stalk to middle to ectal part of atrium. Male pores paired; located in line with ventral setae in posterior part of XI. Spermathecae (Fig. 3D) long and narrow, with 90 degree bend at point where duct enters ampullae; ducts long and hollow, 41–59  $\mu\text{m}$  long, 18–23  $\mu\text{m}$  wide; ampullae thin-walled and elongate, 33–59  $\mu\text{m}$  long, 14–23  $\mu\text{m}$  wide. Sperm in random masses. Spermathecal pores paired, in line with ventral setae in X near intersegmental furrow IX/X.

*Remarks.*—This species is closely related to *Adelodrilus cooki* Erséus, 1978, and *A. pilatus* Erséus and Davis, 1984. All three species share the following characteristics: single-pointed setae in the ventral bundles of IX and X, spoon-shaped giant penial setae accompanied by intermediate penial setae, and small penial setae. It is also likely that *A. pusillus* Erséus, 1978, *A. kiselevi* (Finogenova, 1972), and *A. correptus* Erséus and Davis, 1984, are closely related to this group but these species do not have the modified setae in the ventral bundles of IX and X. *Adelodrilus bacronis* is most easily distinguished from the other species in this group by the geniculate shape of both the intermediate penial setae and the spermathecae.

*Habitat.*—Sublittoral, medium to coarse sand, 71–78 m.

*Distribution.*—Northeast coast of the U.S.: off Massachusetts (Georges Bank).

*Phallodrilus dorsospermatheca*, new species

Figs. 4, 5

*Holotype.*—USNM 97233.

*Type-locality.*—Georges Bank, SE of Massachusetts, USA, sta. 2, 40°59.0'N, 66°55.8'W, 71 m, medium sand, Feb 1984.

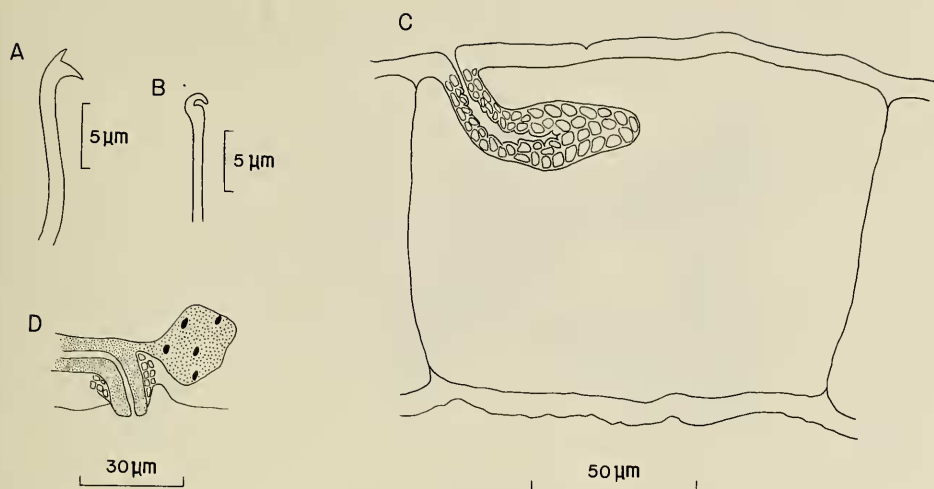


Fig. 5. *Phallosodrilus dorsospermatheca*: A, Somatic seta; B, Penial seta; C, Lateral view of spermatheca in segment X; D, Pseudopenis partially everted.

*Paratypes*.—USNM 97234–97235. Two specimens from off Massachusetts (Georges Bank), both from type-locality.

*Other material examined*.—Three specimens from off Massachusetts (Georges Bank), all from type-locality.

*Etymology*.—The name *dorsospermatheca* refers to the dorsal position of the spermatheca.

*Description*.—Length 3.8–5.3 mm, 34–38 segments; 66–99  $\mu\text{m}$  wide anteriorly, 84–99  $\mu\text{m}$  wide at segment XI, 55–90  $\mu\text{m}$  wide posteriorly. Clitellum not observed in specimens examined. Secondary annulation very weak or not present. Prostomium conical and rounded,  $1\frac{1}{2}$  times long as wide. Somatic setae (Fig. 5A) similar in shape throughout, sigmoid, bifid, upper tooth thinner and shorter than lower tooth; 30–36  $\mu\text{m}$  long, 1.5–1.8  $\mu\text{m}$  thick, 3–4 per bundle anteriorly; 28–33  $\mu\text{m}$  long, 1.5–1.8  $\mu\text{m}$  thick, (1)–2–(3) per bundle posteriorly. Ventral setae of segment XI modified into penial bundles (Fig. 4:ps), each containing 4 setae. Penial setae (Fig. 5B) straight, single pointed, ectally hooked and clubbed, about 22  $\mu\text{m}$  long, 1  $\mu\text{m}$  thick (very difficult to establish exact size); situated perpendicular to long axis of worm.

Pharyngeal glands located in segments V and VI and anterior part of VII. Male genitalia (Fig. 4) paired in segment XI. Vas deferens (Fig. 4:vd) short, thin-walled, ciliated; 70–75  $\mu\text{m}$  long, 4.5–6.3  $\mu\text{m}$  wide; entering atrium apically. Atrium (Fig. 4:a) straight and elongated, nearly erect; moderately thick outer lining; thick, granulated and ciliated inner epithelium; opening into small, simple copulatory sac (Fig. 4:cs); ectal tip capable of being protruded to form short, thick pseudopenis (Fig. 4:pp). Anterior prostate gland (Fig. 4:pr1) small, compact; situated ventral to atrium; attached to ental end of atrium, near entrance of vas deferens. Posterior prostate (Fig. 4:pr2) small, compact; situated directly posterior to atrium; attached to atrium ectally by short stalk. Male pores paired; in line with ventral setae in posterior part of segment XI. Spermathecae (Fig. 5C) small, elongated (probably not completely formed); duct 5–6  $\mu\text{m}$  long, 6–7  $\mu\text{m}$  wide; ampullae 18–36  $\mu\text{m}$

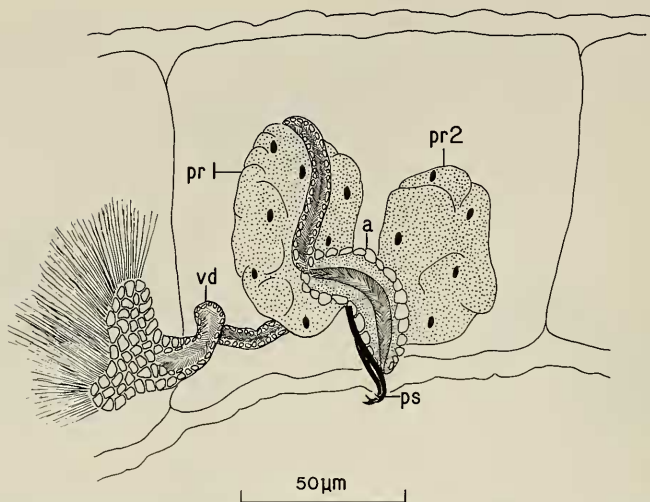


Fig. 6. *Phallodrilus christeri*, lateral view of male genitalia in segment XI. Abbreviations as for Fig. 4.

long, 12–14  $\mu\text{m}$  wide. No sperm observed. Spermathecal pores paired, in line with dorsal setae in anterior part of segment X.

*Remarks.*—As discussed by Erséus (1984a), many species of *Phallodrilus* (*P. coeloprostatus* Cook, 1969; *P. biprostatus* (Baker & Erséus, 1979); *P. parviatriatus* Cook, 1971; and others) from the northwest Atlantic share the feature of small, ectally hooked and clubbed penial setae. *Phallodrilus dorsospermatheca*, which also shares this feature, further supports the view of Erséus that these species are a monophyletic group which has evolved and radiated in the northwest Atlantic.

*Phallodrilus dorsospermatheca* is also similar to *P. minutus* Hrabě, 1973. Both species are small overall with small genitalia, similar penial setae, and spermathecal pores which are more dorsally positioned than those of most other members of the genus *Phallodrilus*. The shape of the protruded pseudopenis shown in the redescription of *P. minutus* (Erséus and Kossmagk-Stephan 1983; Fig. 1:pp) very closely resembles the partly protruded pseudopenis (Fig. 5D) of *P. dorsospermatheca*.

*Phallodrilus dorsospermatheca* differs from *P. minutus* in having smaller and more sharply hooked penial setae and spermathecal pores situated in line with the dorsal setae instead of more laterally.

*Habitat.*—Sublittoral, medium sand, 71 m.

*Distribution.*—Northeast coast of U.S.: off Massachusetts (Georges Bank).

*Phallodrilus christeri*, new species

Figs. 6, 7

*Holotype.*—USNM 97239.

*Type-locality.*—Georges Bank, SE of Massachusetts, sta. 5-1, USA, 40°39.5'N, 67°46.2'W, 79 m, medium to coarse sand, Nov 1983.

*Paratypes.*—USNM 97240–97241. Two specimens from off Massachusetts

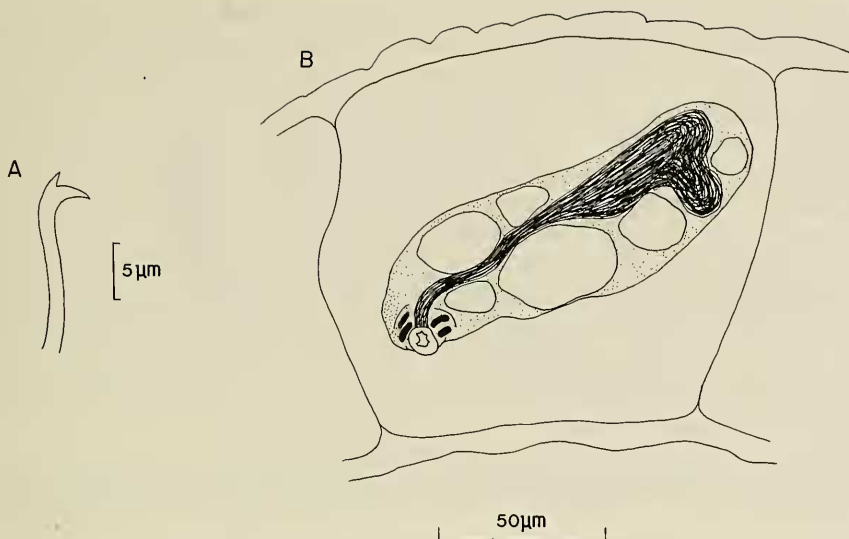


Fig. 7. *Phalldrilus christeri*: A, Somatic seta; B, Lateral view of spermatheca in segment X.

(Georges Bank): one from type-locality; one from sta. 5-18, 40°39.6'N, 67°47.6'W, 80 m, medium to coarse sand, Nov 1984.

*Other material examined.*—Four specimens from off Massachusetts (Georges Bank): three from sta. 5-4, 40°39.5'N, 67°46.5'W, 79 m, medium to coarse sand, May 1983; one from sta. 5-18, 40°39.6'N, 67°47.6'W, 80 m, medium to coarse sand, Nov 1983.

*Etymology.*—This species is named for Dr. Christer Erséus (University of Göteborg, Sweden) who has made many important contributions to the study of marine oligochaetes.

*Description.*—Length 4.0–6.9 mm, 44–50 segments; 67–132 µm wide anteriorly, 134–142 µm wide at segment XI, 55–143 µm wide posteriorly. Clitellum extending over X and XI. Secondary annulation strongly developed, 4–6 annuli per segment. Prostomium conical and rounded, 1½ times longer than wide. Somatic setae (Fig. 7A) similar throughout; bifid, slightly sigmoid, with upper tooth smaller than lower tooth; 38–42 µm long, 1.0–1.5 µm thick, 2–3 per bundle anteriorly; 38–41 µm long, 1.0–1.5 µm thick, 2 per bundle posteriorly. Ventral setae of XI modified into penial bundles (Fig. 6:ps) with each containing 2 setae. Penial setae bifid; long, thin teeth equal in length; upper tooth thicker than lower tooth; shaft slightly sigmoid, sharply curved ectally; 38–48 µm long, 1.5–1.8 µm thick. Penial setae perpendicular to long axis of worm.

Pharyngeal glands small, compact; located in posterior part of III. Male genitalia (Fig. 6) paired in XI. Vas deferens (Fig. 6:vd) moderately thick-walled and ciliated; 150–180 µm long, 6.5–9.0 µm wide; entering atrium ectally. Atrium (Fig. 6:a) small, oval to comma-shaped; moderately thick outer lining; thick, granulated and ciliated inner epithelium; 41–62 µm long, 15–17 µm wide; opening directly to outside through male pore; ectal tip slightly protrusible to form small pseudopenis. Anterior prostate gland (Fig. 6:pr1) small and compact; positioned anterior to atrium; entering atrium entally near entrance of vas deferens. Posterior



prostate gland (Fig. 6:pr2) also small and compact; positioned posterior to atrium; entering atrium ectally. Male pores paired; located in line with ventral setae in middle of segment XI. Spermathecae (Fig. 7B) large and oval; duct very short, 9–14  $\mu\text{m}$  long, 9–10  $\mu\text{m}$  wide; ampullae with very thick and glandular walls, 54–128  $\mu\text{m}$  long, 23–37  $\mu\text{m}$  wide, actual lumen small, filled with random sperm. Spermathecal pores paired, in line with ventral setae in anterior part of X.

*Remarks.*—*Phalldrilus christeri* does not seem to be closely related to any single species, but instead, shares features of several species. The basic shape and structure of the atria are common in this genus. The bifid penial setae are found in only three other species (*P. aquaedulcis* Hrabě, 1960; *P. vulnus* Erséus, 1983b; and *P. cristolatus* Erséus, 1983b), but this is the only feature these species share with *P. christeri*. The male genitalia and the histology of the spermathecae of *P. postspermathecatatus* Erséus, 1980, are similar to the new species, but the spermathecae are located in segment XII and the penial setae are not bifid.

*Habitat.*—Sublittoral, medium to coarse sand, 79–80 m.

*Distribution.*—Northeast coast of the U.S.: off Massachusetts (Georges Bank).

*Phalldrilus parviatriatus* Cook, 1971

*Phalldrilus parviatriatus* Cook, 1971:204–207, fig. 1.—Erséus, 1979c:190.

*Type-material.*—USNM 42015–42017; National Museum of Natural Sciences, Ottawa, Canada, 3413.

*Type-locality.*—Cape Cod Bay, Massachusetts, USA, 41°54.0'N, 70°8.6'W, 17.1 m.

*New material examined.*—Four specimens from off Massachusetts (Georges Bank): one from sta. 5-4, 40°39.5'N, 67°46.5'W, 79 m, medium to coarse sand, Jul 1981; one from sta. 5-22, 40°39.5'N, 67°43.3'W, 77 m, medium to coarse sand, Jul 1981; two from sta. 5-28, 40°39.5'N, 67°41.9'W, 75 m, medium to coarse sand, Feb 1983.

*Remarks.*—The new material conforms in all ways to the original description (Cook 1971) and represents a slight depth extension from 41 m to 79 m.

*Habitat.*—Subtidal, medium to coarse sand, 17–79 m.

*Distribution.*—Northeast coast of the U.S.; New Jersey, Massachusetts (Cape Cod Bay and Georges Bank).

*Olavius tenuissimus* (Erséus, 1979c)

*Phalldrilus tenuissimus* Erséus, 1979c:199–200, fig. 20.

*Olavius tenuissimus.*—Erséus, 1984a.

*Type-material.*—USNM 56208–56212.

*Type-locality.*—Off Miami, Florida, USA, 25°43.0'N, 80°10.2'W, 3 m.

*New material examined.*—Seven specimens from off Massachusetts (Georges Bank): five from sta. 9, 40°26.7'N, 68°09.8'W, 141 m, fine to medium sand, three collected Feb 1982, two collected Nov 1983; two from sta. 12, 40°22.2'N, 68°30.2'W, 103 m, fine to coarse sand, Nov 1983.

*Remarks.*—*Phalldrilus tenuissimus* was thoroughly described by Erséus (1979c). Although the new material examined conforms to the original description, nearly all measurements tended to be in the low end of the size range reported by Erséus.

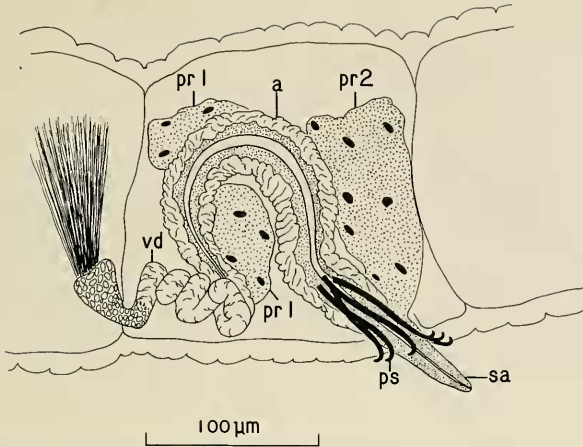


Fig. 8. *Uniporodrilus vestigium*, lateral view of male genitalia in segment XI. sa, styliform atrium; other abbreviations as for Fig. 4.

In the original description, Erséus (1979c) noted that the size of the penial setae varied between material from different localities. As for the other characteristics in the new material, the penial setae tended to be shorter than average (38–51  $\mu\text{m}$  as compared to 41–74  $\mu\text{m}$  in the original description). All specimens in the new material have only one penial seta per “bundle.” All of the material from the original description was found at shallow depths (less than 10 m) while the new material was found only at depths greater than 100 m.

The new material represents a considerable range extension (and depth extension) northward from North Carolina to off Massachusetts (Georges Bank).

*Habitat*.—Subtidal, fine to coarse sand, 0.5–141 m.

*Distribution*.—East coast of U.S.: Florida, North Carolina, Massachusetts (Georges Bank), Bermuda.

*Uniporodrilus vestigium*, new species

Figs. 8, 9, 10

*Holotype*.—USNM 97247. Whole mounted specimen.

*Type-locality*.—Georges Bank, SE of Massachusetts, USA, sta. 5-1, 40°39.5'N, 67°46.2'W, 79 m, medium to coarse sand, Jul 1983.

*Paratypes*.—USNM 97248–97250. One sectioned specimen, two whole mounted specimens from off Massachusetts (Georges Bank): sectioned specimen from sta. 5-11, 40°39.2'N, 67°46.6'W, 80 m, medium to coarse sand, May 1983; whole mounted specimens from type-locality, one collected May 1983.

*Other material examined*.—Two sectioned specimens, three whole-mounted specimens from off Massachusetts (Georges Bank): one sectioned specimen from type-locality; one sectioned specimen from sta. 5-11, 40°39.2'N, 67°46.6'W, 80 m, medium to coarse sand, Jul 1983; one whole mounted specimen from type-locality; one from sta. 5-3, 40°39.8'N, 67°46.1'W, 78 m, medium to coarse sand, May 1983; one from sta. 5-20, 40°38.5'N, 67°46.1'W, 78 m, medium to coarse sand, Nov 1982.

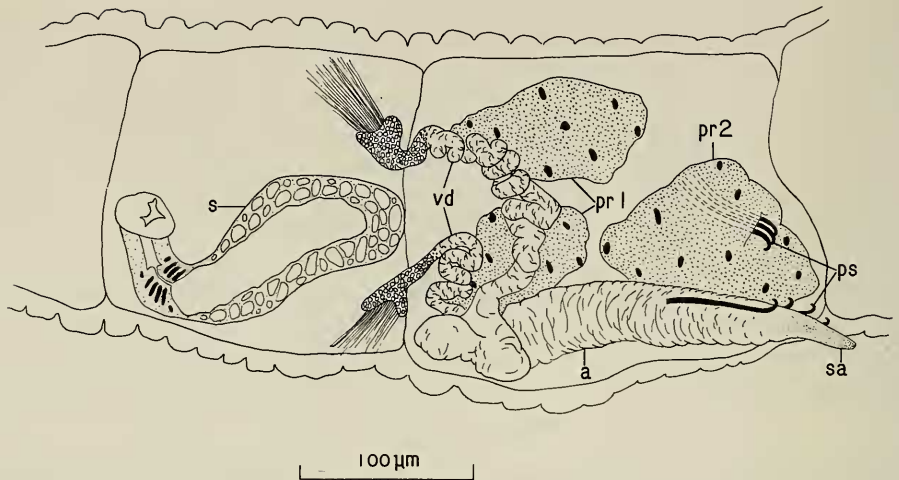


Fig. 9. *Uniporodrilus vestigium*, ventral view of spermatheca and male genitalia in segments X and XI. s, spermatheca; other abbreviations as for Fig. 8.

*Etymology.*—The name *vestigium* is Latin for “footprint,” or something left behind. This refers to one bundle of penial setae which is “left behind” after the atrium from that side of the worm has disappeared.

*Description.*—Length 5.5–7.1 mm, 48–54 segments; nearly uniform width throughout, 205–223  $\mu\text{m}$  wide at segment XI. Clitellum extending over XI and XII. Prostomium conical and rounded, slightly longer than wide. Secondary annulation strongly developed, 6–7 annuli per segment. Somatic setae (Fig. 10A) similar throughout, slightly sigmoid, bifid with upper tooth smaller than lower tooth; 35–51  $\mu\text{m}$  long, 1.8–2.0  $\mu\text{m}$  thick, 2–3 per bundle anteriorly; 33–42  $\mu\text{m}$  long, 1.5–1.8  $\mu\text{m}$  thick, 2 per bundle posteriorly. Ventral setae of segment XI modified into penial bundles (Figs. 8–9:ps), each containing 4–6 setae. Penial setae slightly sigmoid, single pointed and ectally hooked; 70–78  $\mu\text{m}$  long, 2.0–2.5  $\mu\text{m}$  thick; situated slightly oblique to parallel to long axis of worm.

Pharyngeal glands small, located in segment V and anterior part of segment VI. Male genitalia (Figs. 8–9): sperm funnels, vasa deferentia, and anterior prostate glands paired; atrium and posterior prostate gland unpaired; in segment XI. Vasa deferentia (Figs. 8–9:vd) highly coiled, with thick muscular walls; vas deferens of side lacking atrium longer than other side, running under nerve cord and entering atrium apically, approximately 380  $\mu\text{m}$  long; vas deferens of atrium side entering atrium apically near entrance of other vas deferens, approximately 270  $\mu\text{m}$  long. Atrium (Figs. 8–9:a) large, horseshoe-shaped, with thick, very muscular outer lining and thick, granulated inner epithelium; 250–345  $\mu\text{m}$  long, 72–77  $\mu\text{m}$  wide. Ectal tip of atrium styloform (Figs. 8–9:sa) and capable of protruding through body wall.

Anterior prostate glands (Figs. 8–9:pr1) small; one on atrium side of worm, entering atrium entally; one on side lacking atrium, possibly vestigial, attachment to atrium not seen. Posterior prostate gland (Figs. 8–9:pr2) very large, extending over both sides of worm, attached to ectal end of atrium. Male pore unpaired, located in line with ventral setae of atrium side of worm in posterior part of

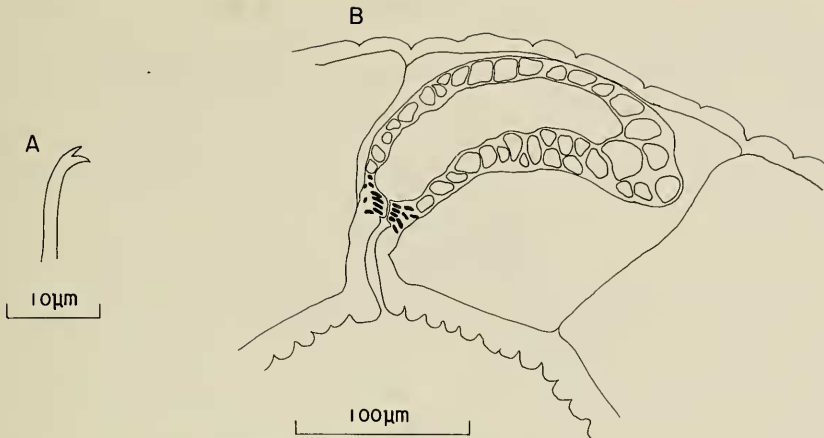


Fig. 10. *Uniporodrilus vestigium*: A, Somatic seta; B, Spermatheca.

segment XI. Spermatheca (Figs. 9:s, 10B) unpaired, very large; duct moderately long and hollow, with first  $\frac{3}{4}$  having wide lumen to act as vagina to receive styliform atrium, last  $\frac{1}{4}$  constricted, 50–55  $\mu\text{m}$  long, 23–32  $\mu\text{m}$  wide; ampullae elongate-oval, sometimes slightly curved, with walls very thick containing large glandular spheres and smaller, yellowish spheres probably containing lipids, 145–230  $\mu\text{m}$  long, 62–80  $\mu\text{m}$  wide, walls up to 20  $\mu\text{m}$  thick. Sperm in random masses. Spermathecal pore unpaired, mid-ventral or slightly to one side; in segment X near intersegmental furrow of IX/X.

*Remarks.*—*Uniporodrilus vestigium* is closely related to *U. granulothecus* Erséus, 1979b. The new species differs in having only one posterior prostate gland, the male pore being in line with the ventral setae instead of being mid-ventral, and the spermathecal pore in segment X instead of segment IX. The new species also has a more muscular atrium and vasa deferentia and fewer penial setae.

With the addition of this species, the generic description of *Uniporodrilus* Erséus, 1979b, is slightly modified to include species with the spermathecal pore in segment X, the male pore in line with the ventral setae, and one posterior prostate gland. If other species of this genus are found, it is likely that these characteristics will be highly variable. The most important generic characteristics are the unpaired atrium and spermatheca.

*Habitat.*—Sublittoral, medium to coarse sand, 78–80 m.

*Distribution.*—Northeast coast of the U.S.: off Massachusetts (Georges Bank).

#### *Bathydriulus longus* Erséus, 1979d

*Bathydriulus longus* Erséus, 1979d:144–145, fig. 9.

*Type-material.*—USNM 55693–55700.

*Type-locality.*—Continental shelf off the coast of New Jersey, USA, NW Atlantic, 30°06.6'N, 72°59.0'W, 70 m.

*New material examined* (new records). Four specimens from off Massachusetts (Georges Bank): two from sta. 16, 40°34.2'N, 67°12.3'W, 138 m, medium to coarse sand, Nov 1983; one from sta. 12, 40°22.2'N, 68°30.2'W, 103 m, medium to



coarse sand, Nov 1983; one from sta. 7, 40°28'N, 67°43.2'W, 165 m, medium to coarse sand, Jul 1981.

*Remarks.*—*Bathyrilus longus* was thoroughly described by Erséus (1979d). The new specimens conform in most respects to the original description, with two notable exceptions. In two of the specimens examined, the male pores appeared to be located in the anterior part of segment XII. It was very difficult to establish the exact position of the septum between segments XI and XII but it was clear in these two specimens that the male pores are situated more posteriorly than depicted in the illustration for the original description (Erséus 1979d, fig. 9).

The other exception to the original description is the length of the atrium. Three of the specimens examined have atria with lengths of 270–320  $\mu\text{m}$ , which is considerably longer than the originally reported lengths of 185–250  $\mu\text{m}$  long.

This material represents a slight range extension northward from off New Jersey to off Massachusetts. This material was also found at slightly deeper depths of 103–165 m as compared to 70–91 m for the type material.

*Habitat.*—Sublittoral, medium to coarse sand, 70–165 m.

*Distribution.*—Northeast coast of the U.S.: off New Jersey and Massachusetts (Georges Bank).

*Heterodrilus occidentalis* Erséus, 1981

*Heterodrilus occidentalis* Erséus, 1981:121, fig. 11.

*Type-material.*—USNM 60606–60610.

*Type-locality.*—Near Beaufort, North Carolina, USA, 34°41'58"N, 76°37'20"W, 5 m.

*New material examined* (new records).—Three specimens from off Massachusetts (Georges Bank): two from sta. 15, 41°27.5'N, 68°00.7'W, 38 m, fine to medium sand, Jul 1981; one from sta. 16, 40°34.2'N, 67°12.3'W, 138 m, medium to coarse sand, Nov 1981.

*Remarks.*—The new material conforms in all ways to the original description (Erséus 1981). These records represent a slight range extension northward from New Jersey to off Massachusetts. One of the new specimens was found at 138 m, which is a considerable depth extension from 24 m.

*Habitat.*—Subtidal, fine to coarse sand, 4.5–138 m.

*Distribution.*—East coast of U.S.; North Carolina, New Jersey, and Massachusetts (Georges Bank).

*Limnodriloides medioporus* Cook, 1969

Fig. 11

*Limnodriloides medioporus* Cook, 1969:21–22, fig. 7; 1970b:980; 1971:212; 1974, 131.—Brinkhurst and Jamieson, 1971:530, fig. 8.24 A–C.—Erséus, 1982:225–226, fig. 9.

*Type-locality.*—Cape Cod Bay, Massachusetts, USA, 41°54.9'N, 70°15.12'W, 36.5 m.

*New material examined.*—Six specimens from off Massachusetts (Georges Bank): four from sta. 13, 40°29.5'N, 70°12.6'W, 67 m, silt to very fine sand, Nov 1983; one from sta. 13A, 40°30.0'N, 71°00.5'W, 78 m, silt, Nov 1983; one from sta. 7A, 40°32.15'N, 67°44.2'W, 165 m, silt to very fine sand, Feb 1984.

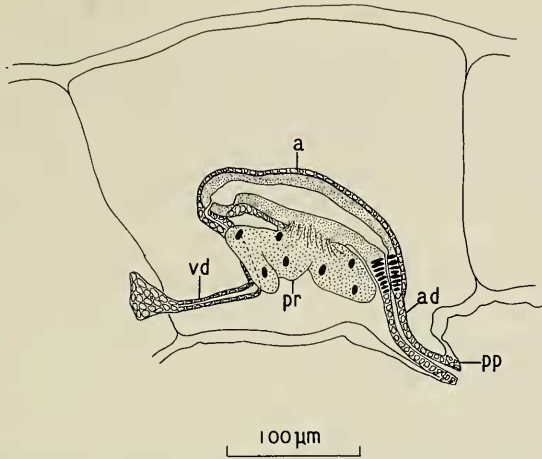


Fig. 11. *Limnodriloides medioporus*, lateral view of male genitalia in segment XI, with pseudopenis everted. pr, prostate gland; ad, atrial duct; other abbreviations as for Fig. 4.

*Remarks.*—The specimens examined here conform in every way to the original description with one minor exception. The original description (Cook 1969) states that there are two somatic setae per bundle posteriorly. In the new material, there were occasionally only one or up to three per bundle. The median pore is often not visible, depending on whether the penes are everted or not. These can vary from the relaxed state, as in the original description (Cook 1969, fig. 7), to the fully everted position (Fig. 11). In many cases, the penes will be only partially everted so the median pore disappears, which is confusing for identification purposes.

*Habitat.*—Subtidal silt to medium sand, 18–97 m.

*Distribution.*—Northeast coast of U.S., Massachusetts through New Jersey.

*Limnodriloides barnardi* Cook, 1974

*Limnodriloides barnardi* Cook, 1974:134–135, fig. 5.—Erséus 1976:32–33, fig. 3; 1982:232–234, not fig. 13.

*Limnodriloides winckelmanni* Michaelsen, 1914:—Jamieson, 1977:338, not fig. 2.

*Type-material.*—USNM 48730–48731.

*Type-locality.*—Bahía de San Quintín, Pacific coast of Mexico, less than 2 m.

*New material examined* (new records).—Three specimens from off Massachusetts (Georges Bank); all from sta. 12, 40°22.2'N, 68°30.2'W, 103 m, medium to coarse sand, Nov 1983.

*Remarks.*—*Limnodriloides barnardi* was thoroughly described by Cook (1974) and subsequently reviewed by Erséus (1982). The new material examined conformed closely to the material examined by Erséus from the northern localities along the U.S. east coast.

In the specimens studied here, the male and spermathecal pores were located very close together. The male pores were so close together in one specimen that they formed an I-shaped common median bursa. The spermathecal setae were

also smaller than those of the type-material (65–77  $\mu\text{m}$  compared to 110–120  $\mu\text{m}$ ), but were all located posterior to the spermathecal pores.

This material represents a slight northward range extension on the east coast of the U.S. from New Jersey to off Massachusetts (Georges Bank).

*Habitat.*—Subtidal, silt to coarse sand, 0.5–150 m.

*Distribution.*—Massachusetts, New Jersey, Maryland, Virginia, North Carolina, East coast of Florida, Bahamas, Bermuda, and Pacific coast of Mexico.

*Tubificoides intermedius* (Cook, 1969)

*Pelosclex intermedius* Cook, 1969:11–12, fig. 2.—Brinkhurst and Jamieson, 1971: 512–513, fig. 8.22 K, L.—Holmquist, 1978: fig. 6B.

*Tubificoides intermedius* Brinkhurst and Baker, 1979:1559, fig. 7.

*Type-material.*—USNM 38259–38262.

*Type-locality.*—Cape Cod Bay, Massachusetts, USA, 41°55.75'N, 70°21.07'W, 42.6 m.

*New material examined.*—Three specimens from off Massachusetts (Georges Bank); all from sta. 13, 40°29.5'N, 70°12.6'W, 67 m, silt to very fine sand, one collected Nov 1982, two collected Nov 1981.

*Remarks.*—The new material examined here conforms in most ways to the original description (Cook 1969); however, as mentioned by Brinkhurst and Baker (1979), the illustration in the original description (Cook 1969, fig. 2) is not accurate. The illustration by Holmquist (1978, fig. 6B) very accurately depicts the male genitalia as seen in a whole mount in the material examined here.

*Habitat.*—Subtidal, silt to very fine sand, 7–67 m.

*Distribution.*—Northeast coast of U.S.; Massachusetts (Cape Cod Bay and Georges Bank),

*Marionina welchi* Lasserre, 1971

*Marionina welchi* Lasserre, 1971:453–454, fig. 2.

*Type-material.*—USNM 43479–43481.

*Type-locality.*—Cape Cod Bay, Massachusetts, USA, 41°54.00'N, 70°08.40'W, 17 m.

*New material examined* (new records).—Six specimens from off Massachusetts (Georges Bank): one from sta. 5-10, 40°39.4'N, 67°46.9'W, 80 m, medium to coarse sand, Jul 19-14, 40°39.5'N, 67°44.7'W, 79 m, medium to coarse sand, Jul 1981; one from sta. 5-2, 40°39.6'N, 67°45.8'W, 78 m, medium to coarse sand, May 1982; one from sta. 5-1, 40°39.5'N, 67°46.2'W, 79 m, medium to coarse sand, Nov 1983; two from sta. 5-18 40°39.6'N, 67°47.6'W, 80 m, medium to coarse sand, Nov 1983.

*Remarks.*—The new material conforms in every way to the original description (Lasserre 1971). *Marionina welchi* was previously known only from Cape Cod Bay, Massachusetts. Although the new material does not represent a geographical range extension, it certainly represents a considerable habitat extension.

*Habitat.*—Subtidal, medium to coarse sand, 14.6–80 m.

*Distribution.*—Northeast coast of U.S.; Massachusetts (Cape Cod Bay, Georges Bank).

### Unidentified Material

This group, with the exception of *Phallogdrilus* sp. A, represents species which have not been identified because of problems within their respective taxonomic groups. *Phallogdrilus*, sp. A has been confirmed to be a new species by Erséus (pers. comm.), but there was only one specimen found during the program. This species will be described by Erséus if it is determined that a complete description can be obtained from this one specimen.

The genus *Tubificoides* is in dire need of revision, which often makes identifications questionable. This is the case for *Tubificoides*, sp. A and B. Species A is similar to *T. maureri*, but the opening in the penial sheath seems to be more lateral in *T. maureri*. Species B keys out to be *T. apectinatus* using the key to the species of *Tubificoides* by Brinkhurst and Baker (1979). The problem lies in the difference between the original description (Brinkhurst 1965:133–134, fig. 5, O–T) and the description by Brinkhurst and Baker (1979:1559, fig. 9). There is a considerable difference in the shape of the penial sheath in these two descriptions, making it difficult to know which is correct. These problems will probably not be remedied until the revision of this genus is complete.

Four new species of *Grania* were found from Georges Bank and confirmed by Erséus (pers. comm.). The descriptions of these species will be included in a revision of the genus *Grania*, which is currently being undertaken by Erséus and Coates (Erséus, pers. comm.).

The species designated as *Oligochaeta*, n. fam., sp. A, represents what is probably a new family, which has been found in other material from along the east and west coasts of the U.S. and the Caribbean (Erséus, pers. comm.). The material from Georges Bank, along with material from the other locations, is currently being worked out by Erséus (pers. comm.).

### Discussion

No specific data were recorded on life history or sediment-species relationships during the Georges Bank Monitoring Program; however, many obvious trends were observed which were consistent throughout the three-year program and should be noted. It should be emphasized that these observations are not based on quantitative data.

### Sediment-Species Relationships

The sediment at Station 5 consisted mainly of medium to coarse sand, a feature shared by only two other stations (2 and 16). All other stations had a higher percentage of fine sand, except Stations 13, 13A and 14A, which were predominantly silt. This “medium to coarse sand” habitat is obviously preferred by most oligochaetes. In the three stations with this sediment type, there were generally about 50 to 75 specimens per sample with up to 20 species present. In the stations with higher percentages of fine sand, there were rarely more than 25 specimens per sample and generally not more than five species present. In the stations with high amounts of silt, there were large numbers of only one to three species.

The medium to coarse sand sediments were dominated by members of the subfamily Phallogdrilinae; *Phallogdrilus*, *Adelodrilus*, and *Uniporodrilus*. *Bathydri- lus* is the only member of this subfamily that was not found in the coarse sediment,



which may be an indication of its relationship to the Phallo-drilinae. All species of the family Enchytraeidae reported herein were also found in the coarse sediments.

The finer sediments were dominated by *Limnodriloides medioporus* and *Tubificoides*, sp. A. *Bathydrius longus*, *Heterodrilus occidentalis*, *Limnodriloides barnardi*, and the gutless Phallo-drilinae occurred repeatedly at specific stations without any apparent relationship to sediment type.

The stations with silty sediments always had large numbers (up to 300 per sample) of *Limnodriloides medioporus* which were usually accompanied by a few specimens of *Tubificoides intermedius* and/or *Tubificoides*, sp. B.

#### Life Histories

Sexually mature specimens of many of the species were found in all samples suggesting that they are capable of reproducing year-round. It was quite apparent that the number of sexually mature specimens for all species was higher in the November samples; however, *Adelodrilus pilatus* seemed to be the only species that was sexually mature exclusively in November.

There are obviously some species with a much lower number of sexually mature individuals than juveniles at any time of the year when compared to the "usual number," which can be shown by example. *Tubificoides*, sp. B was relatively common in nearly all samples from Station 13A, but only three sexually mature specimens were found during the entire program. For most species, there were usually at least a few sexually mature individuals in every sample.

#### Geographical Distribution

Nearly all of the species from Georges Bank are limited in their distribution to the northeast coast of the United States. The distribution of *Olavius tenuissimus* extends south to Florida and Bermuda and *Limnodriloides barnardi* may be cosmopolitan in its distribution, being found from the east and west coasts of North America.

The unidentified species such as *Tubificoides*, sp. B and the *Grania* complex may be more widely distributed if they turn out to be known species.

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